



Methodology for Asset Prioritization

The National Infrastructure Simulation and Analysis Center (NISAC), a program under the Department of Homeland Security's (DHS) Preparedness Directorate, provides advanced modeling and simulation capabilities for the analysis of critical infrastructures, their interdependencies, vulnerabilities, and complexities. These capabilities help improve the robustness of our nation's critical infrastructures by aiding decision makers in the areas of preparedness, consequence and risk analysis, policy analysis, investment and mitigation planning, education and training, and near real-time assistance to crisis response organizations.

Sandia National Laboratories (SNL) and Los Alamos National Laboratory (LANL) are the prime contractors for NISAC, integrating the two laboratories' expertise in infrastructure disruption/vulnerability modeling and simulation under the direction of DHS's Infrastructure Protection/Risk Management Division.

Prioritization: A Tool for Informed Decision Making

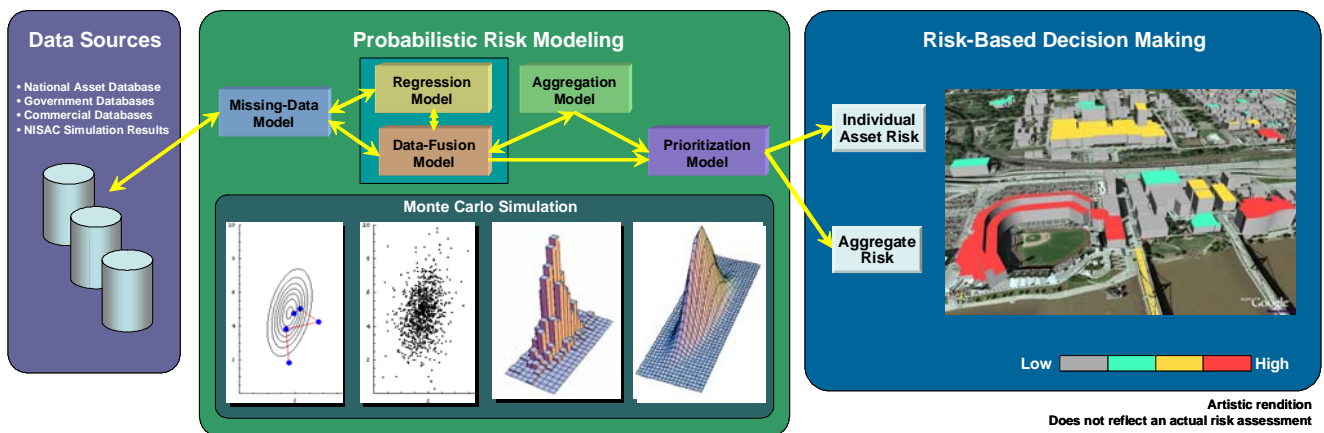
Our nation's critical infrastructures and key resources are comprised of a multitude of physical, human, and cyber assets both privately and publicly owned. These assets include the buildings, bridges, power lines, river vessels, pipelines, cables, power plants, stadiums, schools, and many other facilities that contribute to our daily life.

IP/RMD has responsibility to prioritize both individual assets and aggregate entities such as ports, cities, and states for protective measures. This task requires defensible methodologies that are logically consistent, objective, and applicable across domains of various scale.

Methodology for Asset Prioritization (MAP)

To support IP/RMD, the MAP team is developing a framework for risk-based prioritization, utilizing numerous information sources and integrating existing infrastructure models. The framework is based on rigorous statistical techniques to manage uncertainty.

High-level overview of Methodology for Asset Prioritization.



The Methodology for Asset Prioritization Task

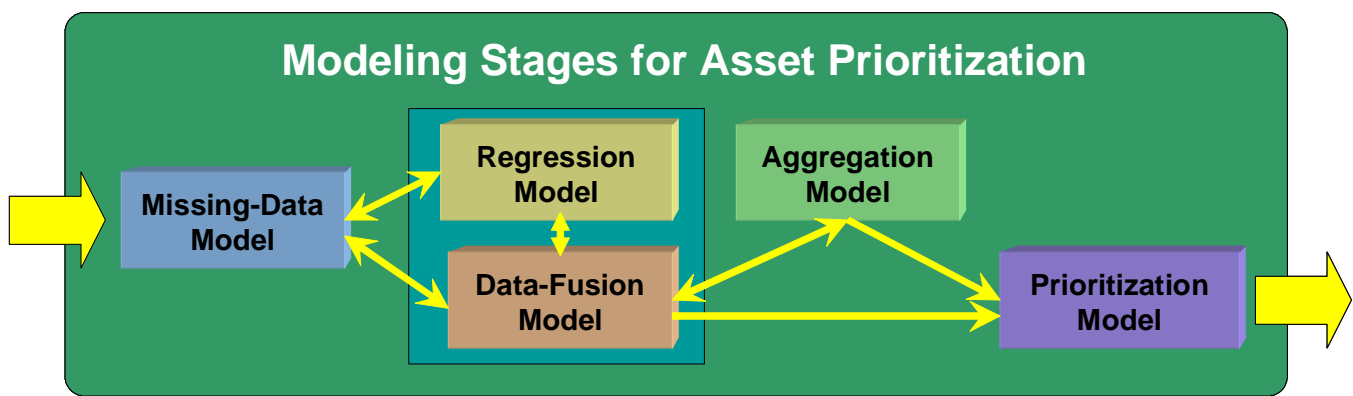
A multi-year research and development effort, the MAP project also provides analytical capabilities to IP/RMD to assist in year-to-year improvements of the methodologies. Ongoing efforts include:

- Improvements in the mathematical soundness and defensibility of the risk formulations
- Analysis of the model sensitivity to adjustable parameters
- Integration of NISAC interdependency and cascading effect simulations into risk calculations

Long-term efforts focus on the development of advanced mathematical models:

- State of the art probabilistic treatment of uncertainty in all components of risk
- Integration of incomplete data from diverse sources
- Framework for mitigation investment strategies and analysis of adversary response

As part of the long-term effort, MAP also helps specify future data capabilities to enable operation of sophisticated infrastructure asset risk calculations.



The MAP Prioritization Process

MAP has separated the risk analysis process into five modeling stages to support investment decision making. The five stages are applied to the three components of risk: Threat, Vulnerability and Consequence.

The **Missing-Data** model estimates value distributions for unknown asset attributes imputed from existing data. Assets are categorized according to an established taxonomic hierarchy. Unknown attribute value distributions are estimated based on the distribution of attribute values from the family of assets in the corresponding category.

The **Regression** model associates risk information with asset attributes. This allows the estimation of risk when simulation data or expert assessment is not available.

The **Data Fusion** model provides a mathematically sound mechanism for combining infrastructure data from different simulations and databases in a consistent and coherent way.

The **Aggregation** model will enable the summation of risk within common geographic regions. This capability is necessary to support inclusion of data that is specified at different scales. Threat values, for example, may be specified for city, state or regional areas as well as for individual assets.

The **Prioritization** model uses the results of the previous four models combined with established prioritizations data to prioritize in new situations. The addition provided by this model is the ability combine consequence information with differing units.



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